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Robotics

Lectures

CO21-006-e

Robotics in rehabilitation of walking dysfunction

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Keywords: Robotics; Gait; Neurological rehabilitation

Research groups have demonstrated that robotically mediated therapy leads to improvement in arm and leg function for patients after central nervous system (CNS) injury. For 2 decades now, research has shown robotic devices may be useful to augment outcomes of patients recovering from stroke and CNS injuries, with a focus on walking and arm function.

Patients who received robot-assisted therapy had greater recovery compared to a placebo, and improvements were maintained at a three-year follow-up. Studies of efficacy of robotic therapy have demonstrated varying degrees of success.

More recently, robots have been transformed from tethered devices to untethered mobility systems that have greatly expanded ambulation options for Individuals with Spinal Cord Injury. ReWalk™ has bilateral hip and knee joint motors, batteries and a computerized control system in a backpack. Users control their walking through subtle trunk motion and changes in center of gravity. The device is intended for use with crutches for stability and because of its similarity to upright bipedal walking, it may offer the potential to resolve some of the physical and mental health problems caused by loss of walking.

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Beyond evidence: Integrating rehabilitation robotics into clinical practice

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Keywords: Stroke; Robotics; Neuro-recovery; Efficacy; Efficiency; Guidelines

Rehabilitation robotics for the upper extremity has matured quite a bit since the development of the MIT-Manus [1]. This is clearly stated in the 2010 American Heart Association and Veterans Administration guidelines for stroke care endorsing the use of rehabilitation robots for the upper extremity guidelines [2,3]. That said, robotics is no panacea and for clinical effectiveness, we should follow some basic motor learning concepts to bring the average patient improvement over the MCID of 5 points in Fugl–Meyer Assessment. Here, we will be discussing our efforts to implement robot-assisted intervention as standard clinical practice and also the many results that often challenge conventional clinical beliefs.

References

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Oral communications

CO21-001-e

The mechanical properties of the glenohumeral joint en masse: In vivo robotic testing

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Keywords: Glenohumeral joint; Joint mobilization; Robotic simulation; Load-displacement curve

Joint mobilization is characterized by great inter-subject and inter-session variability. There is a definite non-linear relationship between force exerted by the therapist and displacement (tissue-response), which are quantifiable simultaneously. We employed a 6 DOF robotic manipulator to perform AP glide mobilization movement (APG) of the glenohumeral joint (GHJ). Twenty-two healthy subjects participated. The APG movements were performed with the GHJ in 60° of ER, neutral position, and 60° of IR. Several points were determined from the load-displacement curves, the beginning of toe-region and of holding phase, the end of toe-region and of holding phase, intersection of lines representing neutral-zone and linear-elastic region.

The outcome measures were displacement, force, and stiffness. The results showed that both displacement and stiffness exhibited a main effect of arm position (P ranged from .001–.044). Significant gender effect on displacement was found. Moreover, the load-displacement relation obtained from IR and ER exchanged their priority in magnitude of displacement in toe-region. Such results may not be explained totally by the convex-concave principle; roles

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